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(54) Title: POLYMERIZED WAX CANDLES

(57) Abstract: A candle made with a wax base and a synthetic thermoplastic rubber copolymer. The wax base may be prepared from a variety of sources including petroleum sources, animal sources, vegetable sources, synthetic sources, and blends thereof. The synthetic thermoplastic rubber copolymer may be a diblock, triblock, radial block, multiblock copolymers, and blends thereof. In addition to the wax base and the synthetic thermoplastic rubber copolymer, candles made according to the invention can also include stabilizers, fragrances, dyes as well as other standard candle additives. Moreover, candles produced according to the invention have several cost saving advantages. The addition of the synthetic thermoplastic rubber copolymer allows for the production of high quality candles while utilizing less expensive wax bases. Additionally, disclosed candles decrease processing times and percent defects.

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POLYMERIZED WAX CANDLES

TECHNICAL FIELD

Candles comprising a wax base and a copolymer of synthetic thermoplastic rubber copolymer additives are disclosed. The copolymer additive is useful for binding excess oil within the candle thereby allowing for the production of quality candles from less expensive base wax. Methods of manufacturing candles comprising a wax base and a copolymer of synthetic thermoplastic rubber additives are also disclosed.

BACKGROUND OF THE RELATED ART

Candles have long since been used as an accepted method of giving light, heat, scent, or for celebration or votive purposes. Candles made from a variety of wax bases are well known within the art. Typically, a wax base is derived from petroleum sources, vegetable sources, animal sources, synthetic sources, or some mixture thereof. The wax materials of candles are typically of high quality having a low amount oil therein. A low amount of oil within the candle is associated with a high quality candle.

Despite the low costs of using crude wax as a wax base, high quality candles produced from crude wax are expensive because the crude wax must be refined into higher quality wax. During the refining process, a crude wax, which may include as much as 20% oil is heated to drive off the oil. The process of driving off the oil also consumes some of the wax. Therefore, a large amount of crude wax is required to obtain a small amount of high quality wax. The large amounts of crude wax and the high costs of refining that crude wax drive up the costs of producing high quality candles.

Due to the low costs of crude wax, it would be desirable to devise a method of producing high quality candles using crude wax. To do this, it is necessary to determine alternate methods of binding or otherwise disposing of the oil that is inherent in crude wax. Currently, no methods, other than expensive refining processes, are available to remove the oil from crude wax.

SUMMARY OF THE DISCLOSURE

5 In satisfaction of the aforementioned needs, an economic method of binding the oil that is inherent within a crude wax or economical wax source is disclosed. The oil within the crude wax is economically bound through the use of a copolymer additive. By adding this copolymer to crude wax, high quality candles can be produced using less expensive crude wax as a starting material.

10 The copolymer additive which is based on synthetic thermoplastic rubbers may be diblock, triblock, radial block or a combination thereof. Copolymers of this type are well known, and are typically used as adhesives, sealants and coatings. For example, synthetic thermoplastic rubber copolymers produced under the tradename KRATON® are used in a variety of environments.

15 A candle utilizing a wax base and a synthetic thermoplastic rubber copolymer is also disclosed. The wax base may come from economical sources such as petroleum sources, vegetable sources, animal sources, synthetic sources or mixtures thereof. Further, the wax base may or may not be classified as a "crude wax". The copolymer used in conjunction with the candle may be a diblock, triblock, radial block, or combinations of diblock, triblock and radial block copolymers. The addition
20 of the copolymer to the wax base binds the oil within the wax, thereby permitting the production of candles with more cost effective materials. It is therefore an object of the invention to prepare candles with lower cost waxes which are presently unable to be used in candle-making preparation.

25 One of the lower cost waxes that are presently not useful in the candle making process are low-melt waxes. Despite their lower cost, these low-melt waxes are not used prevalently because they may melt during shipping during hot months. The addition of the copolymer stabilizes these low-melt waxes, by raising the melt temperature. Thus, if low-melt waxes are used, the concern over melting during shipping is obviated by the addition of the copolymer according to the invention.

30 As an additional method of cost savings, candles produced according to this invention reduce processing times and percent defects. Moreover, the candles can be

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produced using standard candle manufacturing facilities. As such it is an object of this invention to produce candles utilizing an optimized manufacturing process.

In addition to the cost saving benefits, the addition of the copolymer has been found to alter the crystalline structure of the wax bases thereby allowing for the manipulation of the burn rate of the candles. The burn rate manipulation is achieved because the altered crystalline structure provides multiple temperature gradients throughout the candle. It is therefore an object of the invention to provide candles that have longer burn times than conventional candles. In addition to longer burn times, the multiple temperature gradients of the candle provides safety benefits by preventing spillovers because the edges of the candle are substantially cooler than the center pool.

Finally, the disclosed candles are useful for suspending a variety of safety and aesthetic additives. For example, flame retardants can be suspended to extinguish the candle at the desired point. Glitter and other aesthetic additives may also be suspended in the candle.

DETAILED DESCRIPTION OF THE PRESENTLY PREFERRED EMBODIMENTS

A candle made of a composition having a wax source and a thermoplastic copolymer is disclosed. The copolymer is present in an amount of ranging from about 0.125% by weight to about 10% by weight. Preferably, the copolymer is present in an amount ranging from about 0.25% by weight to about 2% by weight.

The copolymer is based on synthetic thermoplastic rubbers, and may be diblock, triblock, radial block or a combination of the three. The synthetic thermoplastic rubbers which are produced under the KRATON® tradename are useful in this invention. The Kraton® rubber polymers, which are produced by the Shell Chemical Company, are elastomers with a high strength and low viscosity. Additionally, KRATON® has a unique molecular structure of linear diblock, triblock or radial polymers. Each molecule of the KRATON® rubber is believed to consist of block segments of styrene monomer units and rubber monomer units and each block segment may consist of 100 monomer units or more. The most common structure is the linear ABA block type; styrene-butadiene-styrene (SBS) and styrene-isoprene-styrene (SIS), the KRATON® D series. A second generation polymer of this series is the KRATON® G series which are styrene-ethylene-butylene-styrene type (S-EB-S)

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polymers. Diblock polymers include the ABA type and the SB. styrene-ethylcnepropylene (S-EP) and (S-EB). The AGA structure of the KRATON® rubber molecule has polystyrene endblocks and elastomeric midblocks. This series of polymers is sold commercially and indicated as being major compounding ingredients or additives in adhesives, sealants and coatings, asphalt modifications for roads and roofing, polymers modification, thermoset modification, and oil modification including use as viscosity index improvers, greases and gels. The KRATON® G rubbers are indicated as being compatible with paraffinic and naphthionic oils and the triblock copolymers are reported as taking up more than 20 times their weight in oil to make a product which can vary in consistency from a "Jello" to a string elastic rubbery material depending on the grad and concentration of the rubber.

The ability of a synthetic thermoplastic rubber copolymer to bind oil allows for the use of inexpensive alternatives for the fuel source or wax base. For example, in the case of paraffinic waxes, instead of using wax that has had all of the oil burned off through the expensive refining process, the inexpensive "slack wax" can be used. Normally, the use of "slack wax" would not produce a candle of suitable quality because of the oil present therein. However, by blending the "slack wax" with the appropriate amount of the synthetic thermoplastic rubber copolymer, the oil is bound. Thus, a high quality candle can be produced from a relatively inexpensive wax source.

Moreover, the addition of the synthetic thermoplastic rubber to a wax base of a candle improves the shipping characteristics of the candle. Often, candles that are prepared with a lower quality wax are damaged by heat during hot shipping months. This problem is overcome in candles that utilize the synthetic thermoplastic rubber copolymer according to the invention. The reason for this is that the copolymer actually works to raise the melt temperature of the wax base. As such, the addition of the copolymer to a wax base reduces the concerns of shipping candles in hot months.

The wax base used in the candle composition is a fuel source. The wax base may come from a variety of sources. For example, the wax base may be made from petroleum sources, vegetable matter, animal-fat matter, synthetic matter, or a combination thereof. Other sources may also be used so long as they are useful as a

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fuel source. Preferably, the wax base is present in the candle composition in an amount greater than 50 percent by weight.

The candle composition may also include other additives such as fragrances, stabilizers, dyes and hydrocarbon oil. Fragrances may be added in an amount up to about 10 weight percent. Stabilizers may be added in an amount of up to 1 percent by weight. Dyes may be added in an amount of up to 2 percent by weight. Finally, hydrocarbon oil may be added in an amount of up to 10 percent by weight.

Candles prepared from compositions according to this disclosure are made in a conventional manner. The candles will include a body portion and at least one wick that is disposed within the body. Depending on manufacturing capabilities, the body of the candle may be formed in a variety of different shapes and sizes. Additionally, multiple wicks may be found within the candle.

Burn testing of candles made in accordance with this disclosure reveals that the addition of the synthetic thermoplastic copolymer to the wax base alters the crystalline structure of the wax base thereby allowing for dynamic and unexpected burn characteristics. One such characteristic is revealed by thermal photography. When candles are lit, they typically produce a wax pool in the area immediately adjacent the wick. The liquefied wax that becomes the fuel for the candle to maintain its flame. Thermal photography reveals that candles that are not produced according to the invention demonstrate sharp temperature gradients. For example, when lit, the area immediately adjacent to the wick can burn at temperatures up to 176°F. The next temperature gradient drops sharply to 140°F. This sharp temperature drop may cause the size of the wax pool to rapidly expand radially. This may lead to the dangerous situation of wax spillover. Candles produced according to the disclosure, however, minimize the risk of spillover because the addition of the synthetic thermoplastic copolymer alters the crystalline structure of the wax base thereby allowing for a much smoother temperature gradient transition within the candle. This gradual temperature reduces the probabilities of wax spillovers because a natural well is formed for the wax to settle in.

One method of preparing begins by heating the wax base to a temperature within the range 170°F to 220°F. After heating, the copolymer additive is mixed in

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for 30 minutes or until homogeneous. Upon the completion of mixing, the batch is cooled to 170°F, whereupon the desired additives, such as stabilizers, dyes, hydrocarbon oils, fragrances, etc., can be added. After the addition of the additives, the entire composition should again be mixed until it is homogeneous. Preparation of the candles is completed when the composition is poured into molds at 170°F.

An alternative method of preparing candles includes the initial step of preparing a copolymer pre-mix in lieu of mixing the full amount of copolymer into the full amount of wax base. This pre-mix may contain from about 1% to about 49% by weight copolymer, and about 51% to about 99% wax base. Due to the fact that the viscosity of the copolymer pre-mix is directly related to the amount of copolymer present, it is preferable to use a pre-mix containing from about 8% to about 12% by weight copolymer, and about 88% to about 92% wax base. The pre-mix is prepared by first heating the requisite amount of wax base to a temperature within the range of about 190°F to about 220°F. After heating the wax, the next step is to add in half of the copolymer. That composition is then mixed until the copolymer is in solution. The remaining copolymer is then added in and mixed until the entire solution is homogeneous.

Preparation of the final candle composition using the copolymer pre-mix is very similar to the preparation without the copolymer pre-mix. The only difference is that instead of mixing the copolymer into the heated wax base directly, the copolymer pre-mix is added to the heated wax base. Thus, the first step is to heat the wax base to a temperature within the range of about 170°F to about 220°F. After heating, the copolymer pre-mix is mixed in for 30 minutes or until homogeneous. Upon the completion of mixing, the batch is cooled to 170°F, whereupon the desired additives, such as stabilizers, dyes, hydrocarbon oils, fragrances, etc., can be added. After the addition of the additives, the entire composition should again be mixed until it is homogeneous. Preparation of the candles is completed when the composition is poured into molds at 170°F.

The aforementioned preparation methods can be employed using standard candle manufacturing facilities. Moreover, candles produced according to the invention reduce processing times and percent defects. These added benefits work to

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further reduce the costs of producing candles.

EXAMPLE 1

5 A candle having a wax base made from petroleum matter was prepared in accordance with the described protocol. The wax base is about 78.75% by weight of the candle composition. Paraffin wax sold by Exxon/Mobil under the trade name Parvan® 129 and micro-crystalline wax sold by Bareco Products under the trade name Be Square® are examples of the types of petroleum matter that may be used to prepare the wax base according to this example. The synthetic thermoplastic rubber
10 copolymer used in this example is a styrene-ethylene-styrene block copolymer. Sold by Shell Chemical Company under the tradename KRATON® 1652, the synthetic thermoplastic rubber copolymer is present in an amount of about 5% by weight. Additionally, stearic acid, sold under the tradename Emersol® 7036 by the Cognis Company, may be present in an amount of about 1% by weight. Other polymers, such
15 as polyethylene sold under the trade name Vybar® 103 by Baker-Petrolite is also present in an amount of 1% by weight. Finally, fragrances and dyes can also present. For example, fragrances such as coconut creme sold by J. Manheimer may be present in an amount of about 5% by weight. Similarly, a dye such as Nitro Fast Blue 2B Powder, sold by the Clariant Corporation, may be present in an amount of about
20 0.25% by weight.

EXAMPLE 2

A candle with a wax base made from vegetable matter is prepared in accordance with the described protocol. The wax base is present in an amount of
25 about 99% by weight, and may be vegetable fatty acids, soybean wax, beeswax or other vegetable based sources. Additionally, a synthetic thermoplastic copolymer such as styrene-ethylene-styrene block copolymer, is also present in an amount of about 1% by weight. KRATON® 1652 sold by the Shell Chemical Company is a suitable example of such a copolymer

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EXAMPLE 3

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5 A candle with a wax base made from animal-fat matter is prepared in accordance with the described protocol. The wax base is present in an amount of about 98% by weight. Suitable animal-fat sources include tallow base fatty acids. Additionally, a synthetic thermoplastic copolymer such as KRATON® 1652 is also present in an amount of about 2% by weight.

EXAMPLE 4

10 A candle with a wax base made from synthetic matter is prepared in accordance with the described protocol. The wax base is present in an amount of about 92% by weight. The synthetic sources that may be used as a wax base include, among others, synthetic paraffin waxes such as Callista 122 made by the Shell Chemical Company, and alpha olefins. Additionally, a synthetic thermoplastic copolymer such as KRATON® 1652 is also present in an amount of about 8% by weight.

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EXAMPLE 5

20 A candle with a wax base made from a mixture of vegetable and petroleum matter is prepared in accordance with the described protocol. The wax base is made of about 55% vegetable matter such as soy and about 45% petroleum matter such as paraffin. The wax base makes up about 99% of the candle composition. The remaining about 1% is made up of a synthetic thermoplastic copolymer such as KRATON® 1652.

25 While the invention has been described in detail and with reference to specific embodiments thereof, it will be apparent to one skilled in the art that various changes and modifications can be made therein without departing from the spirit and scope thereof.

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We claim:

1. A candle composition comprising:
a wax base; and
a copolymer additive selected from the group consisting of diblock, triblock,
5 radial block, multiblock copolymers of synthetic thermoplastic rubbers and mixtures thereof.
2. The candle composition of claim 1, wherein the wax base is made from
petroleum matter.
- 10 3. The candle composition of claim 1, wherein the wax base is made from
vegetable matter.
4. The candle composition of claim 1, wherein the wax base is made from
15 animal-fat matter.
5. The candle composition of claim 1, wherein the wax base is made from
synthetic matter.
- 20 6. The candle composition of claim 1, wherein the wax base is made from a
combination of materials selected from the group consisting of petroleum
waxes, vegetable waxes, animal-fat waxes, synthetic waxes and mixtures
thereof.
- 25 7. The candle composition of claim 1, wherein the wax base is present in an
amount of at least 50 weight percent of the candle composition
8. The candle composition of claim 7, wherein the copolymer additive is present
in an amount ranging from about 0.125 to about 10 weight percent of the
30 candle composition.

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9. The candle composition of claim 8, wherein the copolymer additive is present in an amount ranging from about 0.25 to 2 about weight percent of the candle composition.
- 5 10. The candle composition of claim 1, further comprising:
from about 0 to about 10 weight percent fragrance;
from about 0 to about 1 weight percent stabilizers;
from about 0 to about 2 weight percent dyes; and
from about 0 to about 10 weight percent hydrocarbon oil.
- 10 11. A candle comprising
at least one wick;
a body;
said at least one wick disposed within said body; and
15 wherein said body comprises a wax base and a copolymer additive selected from the group consisting of diblock, triblock, radial block, multiblock copolymers of synthetic thermoplastic rubbers and mixtures thereof.
12. The candle of claim 11, wherein said wax base is made from petroleum matter.
- 20 13. The candle of claim 11, wherein said wax base is made from vegetable matter.
14. The candle of claim 11, wherein said wax base is made from animal-fat matter.
- 25 15. The candle of claim 11, wherein said wax base is made from synthetic matter.
16. The candle of claim 11, wherein said wax base is made from a combination of materials selected from the group consisting of petroleum waxes, vegetable waxes, animal-fat waxes, synthetic waxes and mixtures thereof.
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17. The candle of claim 11, wherein said wax base is present in an amount of at least 50 weight percent of the body.
18. The candle of claim 17, wherein said copolymer additive is present in an amount of about 0.125 to about 10 weight percent of the body.
19. The candle of claim 18, wherein said copolymer additive is present in an amount of about 0.25 to about 2 weight percent of the body.
20. The candle of claim 11, wherein the body further comprises:
from about 0 to about 10 weight percent fragrance;
from about 0 to about 1 weight percent stabilizers;
from about 0 to about 2 weight percent dyes; and
from about 0 to about 10 weight percent hydrocarbon oil.
21. A method of making candles comprising the steps of:
providing a candle molten composition comprising a wax base and a copolymer additive selected from the group consisting of diblock, triblock, radial block, multiblock copolymers of synthetic thermoplastic rubbers, and mixtures thereof;
placing the molten candle composition in a mold to form a candle body;
placing a wick in the molten candle composition; and
allowing the candle composition to harden.
22. The method of claim 21, wherein the wax base is made from petroleum matter.
23. The method of claim 21, wherein the wax base is made from vegetable matter.
24. The method of claim 21, wherein the wax base is made from animal-fat matter.

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25. The method of claim 21, wherein the wax base is made from synthetic matter.
26. The method of claim 21, wherein the wax base is made from a combination of materials selected from the group consisting of petroleum waxes, vegetable waxes, animal-fat waxes and synthetic waxes.
27. The method of claim 21, wherein the wax base is present in an amount of at least 50 weight percent of the candle composition.
28. The method of claim 27, wherein the copolymer additive is present in an amount ranging from about 0.125 to about 10 weight percent of the candle composition.
29. The method of claim 28, wherein the copolymer additive is present in an amount ranging from about 0.25 to about 2 weight percent of the candle composition.
30. The method of claim 21, wherein the candle composition further comprises:
from about 0 to about 10 weight percent fragrance;
from about 0 to about 1 weight percent stabilizers;
from about 0 to about 2 weight percent dyes; and
from about 0 to about 10 weight percent hydrocarbon oil.
31. The method of claim 21, wherein the method further comprises the step of creating a pre-mix of a wax base and a synthetic thermoplastic rubber.
32. The method of claim 21, wherein the wick is predisposed in the mold before the molten candle composition is inserted into the mold.

INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C11C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 00 60012 A (SHELL INT RESEARCH) 12 October 2000 (2000-10-12) page 7, paragraphs 1-3 page 16, paragraphs 5,6 claims 1,3	1,2, 5-12, 15-22, 25-32
X	WO 01 94507 A (PENRECO) 13 December 2001 (2001-12-13) page 5, paragraph 2 page 8, paragraph 3 page 11, paragraphs 1-5 page 14, paragraph 2; claims 1,15-18 -/--	1-32

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
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INTERNATIONAL SEARCH REPORT

International Application No

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 111 055 A (FRIHART CHARLES R ET AL) 29 August 2000 (2000-08-29) column 18, paragraph 6 claims 1,3,4,18; examples 25,26	1-32

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0060012	A	12-10-2000	AU 3558400 A	23-10-2000
			CA 2365488 A1	12-10-2000
			DE 60000735 D1	12-12-2002
			WO 0060012 A1	12-10-2000
			EP 1171527 A1	16-01-2002
			JP 2002541298 T	03-12-2002
			US 6534573 B1	18-03-2003
WO 0194507	A	13-12-2001	AU 7524101 A	17-12-2001
			WO 0194507 A2	13-12-2001
			US 2002022205 A1	21-02-2002
US 6111055	A	29-08-2000	US 5783657 A	21-07-1998
			AU 727577 B2	14-12-2000
			AU 5147098 A	15-05-1998
			BR 9712342 A	31-10-2000
			CN 1238678 A	15-12-1999
			EP 1027032 A1	16-08-2000
			JP 2002516619 T	04-06-2002
			KR 2000049273 A	25-07-2000
			WO 9817243 A1	30-04-1998
			US 6242509 B1	05-06-2001
			US 2002013444 A1	31-01-2002
			AU 727433 B2	14-12-2000
			AU 5091998 A	15-05-1998
			EP 0939782 A1	08-09-1999
			JP 2001502742 T	27-02-2001
			TW 385321 B	21-03-2000
			US 5998570 A	07-12-1999
			WO 9817705 A1	30-04-1998
			US 6169160 B1	02-01-2001

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